GBA

GAGE-BABCOCK & ASSOCIATES, INC.

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LETTER OF TRANSMITTAL

TO: Hamond & Regine
300 Old Country Road, Suite 81GL
Mineola, LI, New York 11501

ATTENTION: Mr. Don Keenan

DATE: April 27, 1993 **JOB NO:** 93160

RE: *Port Authority of NY & NJ Loss Control Report - World Trade Center Complex*

Gentlemen: We are sending you

- ✓ Report
- ___ Schedule of Construction
- ___ Cost Estimates
- ___ Specifications
- ___ Cost Estimates
- ___ Prints
- ___ Mylars
- ___ Change Order
- ___ Plans
- ___ Comments Response

# COPIES	DATE	DESCRIPTION
1 set	4/26/93	World Trade Center Loss Control Report
1 set	4/26/93	World Trade Center Life Safety Enhancements

These are transmitted as checked below:

- _ For Approval
- ✓ For Your Use
- _ As Requested
- _ For Review and Comment
- _ Approved As Submitted
- _ Approved As Noted
- _ Returned for Corrections
- _ Resubmit Copies for proval
- _ Return Corrected Prints

COPY TO: Nelson Chanfrau, PANYNJ SIGNED: Vincent E. Sbarra

Vincent E. Sbarra, PE
FIRE PROTECTION ENGINEER

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PORT AUTHORITY of NEW YORK and NEW JERSEY

World Trade Center
LIFE SAFETY ENHANCEMENTS
Resulting from Experiences during
the Terrorist Bombing

Engineer: Vincent E. Sbarra, P.E. File No. 93160-01
Date: April 26, 1993

WORLD TRADE CENTER
LIFE SAFETY ENHANCEMENTS

As a result of the recent terrorist bombing at the World Trade Center, there have been many life safety enhancement projects which increase the level of both life safety and property protection. These projects have been given top priority and are being conducting with a high degree of haste.

The enclosed "fact sheets" were prepared by the Port Authority. It should be noted that in addition to restoring the existing American Multiplex alarm system (already completed) the fire alarm system will be upgraded by replacing existing risers, transponders and head end computers. The new equipment will be as manufactured by Pyrotronics and will be fully installed prior to switching over the various floors. The resultant alarm systems will have code complying lobby fire command stations and redundant computers for each tower. They will also have style 7 wiring. These improvements will make the fire alarm system considerably more reliable.

WTC LIFE SAFETY ENHANCEMENTS
FACT SHEET

Phosphorescent Re-Entry signs in stairwells

Purpose:

To provide additional back-up illumination and re-entry floor information in the stairwells in the event the primary power and the back-up generator power fails.

Location and Number of Units (Purchase & Installation Cost):

759 units total - One per stairwell, located on the stairwell side of the doors for each re-entry floor in towers #1, #2, #4 & #5. Installation will be staged with the tenant re-occupancy beginning with zone 3 of tower 2. Several companies were contacted for bids. Purchase order was awarded to Ambassador Arts, Inc. They will purchase the phosphorescent material 4100 CCL from Hanovia/Canrad, and silk screen the text in black onto the phosphorescent vinyl backing. The phosphorescent material has a NYC BSA approval (#232-67-SM). Installation will begin on 3/16/93, and zone 3 of tower two is expected to be completed by 3/19/93. Installation of the signs is being coordinated along with the repair/replacement of the stairwell doors that were damaged in the incident. The WTC Structural Maintenance Unit is responsible for the door repairs/replacements as well as the installation of the new signs. The cost per sign, including installation, is $27.69, for a total cost of approximately $21,000.

Operating Characteristics and Technical Description:

Signs are 15" x 20" pressure sensitive (peel & stick) vinyl, with the phosphorescent text silk-screened onto the vinyl material. The sign will indicate for each floor the floor number and whether re-entry in possible on that floor. When exposed to light for a sufficient period of time, they retain the light energy and will remain visible (glow-in-the-dark) in complete darkness for up to 8 hours.

Maintenance (O&M Costs):

Signs must be tested periodically with a light meter for intensity, and replaced when needed.

Other (Comments):

The above is the Phase I implementation. After opening day, the stairwell handrails will be painted with phosphorescent paint and phosphorescent strips will be placed on the stair treads.

Current Status and Issues:

A test of the signs was witnessed by the NYFD on 3/10/93.

GBA COMMENT: Fully installed.

WTC LIFE SAFETY ENHANCEMENTS
FACT SHEET

Vertical Security Patrols

Purpose:

To provide prevention and detection of safety/security problems.
To enhance communication and emergency response capabilities.

Location and Number of Units (Purchase & Installation Cost):

There will be one fire watch guard for each zone in the towers for 12 hours per day (7:00am - 7:00pm), 5 days per week. Each guard will have a flashlight and a radio.

Operating Characteristics and Technical Description:

The guard is an extension of the skylobby fire warden, checking for obstructions and other safety hazards in the stairwells. The guard will also periodically pass through tenant floor corridors when moving between stairwells, increasing visibility and checking that re-entry doors are not locked. The guard will check in at the skylobby communications desk for the assigned zone at the beginning and end of the tour and after each pass through the zone. Furthermore, the guard will communicate with the skylobby desk by radio hourly.

Maintenance (O&M Costs):

The estimated cost is $8,000 per week.

Other (Comments):

Current Status and Issues:

Patrols will be in place when towers re-open. (As other enhancements come on line, the need for these patrols will be reevaluated.)

GBA COMMENT: Presently in Service.

WTC LIFE SAFETY ENHANCEMENTS
FACT SHEET

Battery pack lights for elevators.

Purpose:

To provide emergency lighting in elevators in the event of a power failure and failure of emergency generators.

Location and Number of Units (Purchase & Installation Cost):

Approximately 300 units total. Each shuttle elevator will have two units, each local elevator will have one unit. Approximate cost is $1,000 per unit for a total cost of $300,000.

Operating Characteristics and Technical Description:

6-volt battery packs will be placed on top of cars with lanterns inside cars above doors. Lights will automatically be activated if both the primary power supply and the emergency generators fail. Lights will last for at least 2 hours.

Maintenance (O&M Costs):

Units should be tested periodically and batteries replaced every 4 years. Replacement cost for the batteries is estimated at $35/battery (not including labor).

Other (Comments):

Similar battery pack units with lanterns will also be installed in the elevator machine rooms.

Current Status and Issues:

40 units are currently on site, 100 units will be on site by 3/13/93. Units are being installed and Tower 2, Zones 2 & 3 will be completed by 3/16/93.

GBA COMMENT: Presently installed.

WTC LIFE SAFETY ENHANCEMENTS
FACT SHEET

FM Wireless Communications System

Purpose:

To provide a back-up communications system in case the primary public address or fire alarm intercom systems are rendered inoperable.

Location and Number of Units (Purchase & Installation Cost):

Design and testing has begun for a wireless, independently powered communication system throughout the towers. There will be six base stations (one in each lobby/skylobby) supplemented by approximately 200 floor based stations. Estimated cost for the lobby consoles is $10,000. The floor stations are estimated at $2,000. (Actual costs depend on final system specifications.) Implementation would take place in approximately 2 months. In the interim, each tenant floor warden will be issued a cellular phone to provide a temporary backup communication system. The phones will be programmed to call out to 5 specific WTC emergency/information numbers. (See attached interim system description.)

Operating Characteristics and Technical Description:

The permanent system will use a wall mounted FM radio so OCC and skylobby desks can remain in contact with fire wardens on every floor in the event of an emergency. Advantages of this system over conventional 2-way radios include hands-free operation (no need to push a button to talk), base stations can call individual radios, base stations can identify which radio called them, and radios and base stations are battery powered allowing them to remain operational and be moved in the event of an emergency. Until the permanent system can be installed (2-3 months), the tenant floor wardens will use the pre-programmed cellular phones mentioned above.

Maintenance (O&M Costs):

Not known at this time.

Other (Comments):

Current Status and Issues:

Tests and demonstrations of various wireless system components will begin by opening day.

GBA COMMENT: Work in progress.

WTC LIFE SAFETY ENHANCEMENTS
FACT SHEET

Battery pack lights for stairwells.

Purpose:

To provide emergency power to lights in stairwells in the event of a power failure and failure of emergency generators.

Location and Number of Units (Purchase & Installation Cost):

Approximately 1,300 units total. Each fluorescent light located above a stairwell floor landing (not between floor landings) will have will have a battery pack. In the lobbies and skylobbies, 2 emergency lights will have battery pack backups for each bank of local elevators. These lights will also be provided in all stairwell cross-corridors. Approximate cost is $150 per unit for a total cost of $195,000 not including labor.

Operating Characteristics and Technical Description:

The battery packs will keep a 32 watt single fluorescent tube illuminated for at least 90 minutes.

Maintenance (O&M Costs):

Units should be tested periodically and replaced every 5 years. O&M costs are estimated at approximately $70,000 per year for the testing and replacement of batteries as required.

Other (Comments):

Current Status and Issues:

1,000 battery packs have been ordered and are currently being mounted in the stairwells in towers 1 & 2. Mounting in tower stairwells will be completed by 3/17/93.

GBA COMMENT: Installed.

WTC LIFE SAFETY ENHANCEMENTS
FACT SHEET

Phosphorescent Exit Signs for Main Floor and Mezzanine stairwell exits.

Purpose:

To provide luminous signs to indicate when stairwell evacuees have reached the exit of the stairwell to the main floor in stairwell B and the mezzanine in stairwells A & C. (Additional directional exit signs will also be provided for the mezzanine.)

Location and Number of Units (Purchase & Installation Cost):

One sign per ground floor stairwell exit, located on the wall of the stairwell.

Operating Characteristics and Technical Description:

Signs are pressure sensitive (peel & stick) vinyl, with the phosphorescent text silk-screened onto the vinyl material. The sign will indicate that a evacuees have reached the ground floor and with an arrow, indicate the flow out of the stairwell. When exposed to light for a sufficient period of time, they retain the light energy and will remain visible (glow-in-the-dark) in complete darkness for up to 8 hours.

Maintenance (O&M Costs):

Signs must be tested periodically with a light meter for intensity and replaced when necessary.

Other (Comments):

Current Status and Issues:

GBA COMMENT: Presently installed.

WTC LIFE SAFETY ENHANCEMENTS
FACT SHEET

Satellite communications and control desk with fire warden.

Purpose:

- To provide monitoring of public areas and accessways for enhanced public safety.
- To enhance communication between tenant floors and fire safety personnel.
- To coordinate emergency response activities in each zone.

Location, Number of Units and Cost:

6 units total - One unit in each main lobby and one in each skylobby. Desks will be located adjacent to the existing elevator starter station. Estimated total purchase cost of the units is $330,000 (excluding FM wireless communications system). Estimated total annual cost of fire wardens is aproximately $750,000.

Operating Characteristics and Technical Description:

Equipment - Console contains color CCTV monitors for cameras in zone, wireless communications station, existing standpipe telephone and standard telephone, and an emergency equipment kit. The console is manufactured by EMCOR. A Series 73 Low Silhouette Frame will be used for the desk. ADT Security will provide and install the CCTV monitors and cameras. H&B will wire the desk.

Personnel - Communications desks will be staffed by fire wardens (trained fire safety directors or ex-firefighters), who will be interviewed on 3/15/93 (see list of attached responsibilities). Initially, the desks will be staffed by City-Wide guard supervisors who are ex-firefighters or trained fire safety directors.

Hours Of Operation - Main lobby desks: 24 Hours/day, Skylobby desks: 7:00am-7:00pm (Hours of operation are pending NYFD review of off hour occupancy levels).

Maintenance (O&M Costs):

To be determined.

Other (Comments):

Fire wardens will be given a short WTC orientation course prior to their staffing of the communications desks.

Current Status and Issues:

Design being finalized between Engineering and equipment vendor.
Installation due to be complete for Tower 2, Zone 3 on opening day.
Installation of CCTV cables in Tower 2, skylobby 78 to begin on 3/13/93.

GBA COMMENT: Presently in service.

WTC LIFE SAFETY ENHANCEMENTS
FACT SHEET

Supplemental emergency equipment kit for lobby communications stations.

Purpose:

Emergency equipment will be available to support crowd control/emergency actions.

Location and Number of Units (Purchase & Installation Cost)

6 units total, one for each satellite communications and control desk.

Operating Characteristics and Technical Description:

Backpack to hold equipment, large first aid kit, 2642 keys/drop keys for elevators, 2-way radio, 2 bullhorns, 2 flashlights and 24 dust masks.

Maintenance (O&M Costs):

Test and replace batteries in equipment when necessary. Replace equipment after use. Estimated cost - $500.00 / year.

Other (Comments):

Current Status and Issues:

Currently being purchased. Equipment will be delivered 3/12/93 and stored in WTC Planning and Design offices prior to installation.

GBA COMMENT: Being implemented.

WTC LIFE SAFETY ENHANCEMENTS
FACT SHEET

Tenant Services representatives at skylobby desks.

Purpose:

To assist in the tenant re-occupancy and answer tenant questions.

Location and Number of Units (Purchase & Installation Cost):

N/A

Operating Characteristics and Technical Description:

As a representative of the Port Authority, the Tenant Services staff will be available at each lobby and skylobby desk to answer tenant questions and provide reassurance regarding the enhanced fire safety systems. (First week of tower opening only)

Maintenance (O&M Costs):

N/A

Other (Comments):

Current Status and Issues:

A personnel schedule is being developed to begin implementation on 3/22/93.

GBA COMMENT: This service is being provided.

WTC LIFE SAFETY ENHANCEMENTS
FACT SHEET

Tenant Meetings / Information Kits

Purpose:

To provide tenants with reassurance and information re: WTC Safety
To explain the incident and new fire safety systems being put in place.

Location and Number of Units (Purchase & Installation Cost):

Information kits will be mailed to tenants prior to move in. Meetings will be held in various meeting rooms in the complex. (after move-in)

Operating Characteristics and Technical Description:

(See attached presentation/information kit outlines.)

Maintenance (O&M Costs):

N/A.

Other (Comments):

Current Status and Issues:

GBA COMMENT: Work has started.

WTC LIFE SAFETY ENHANCEMENTS
FACT SHEET

Phosphorescent Signs for Elevators.

Purpose:

To provide illumination indicator for the elevator cab number and location of emergency intercom.

Location and Number of Units (Purchase & Installation Cost):

Each elevator cab will be provided with small phosphorescent indicator strips and numbers.

Operating Characteristics and Technical Description:

Signs are pressure sensitive (peel & stick) vinyl, with the phosphorescent text silk-screened onto the vinyl material. The sign will indicate the cab number and the location of the emergency intercom. When exposed to light for a sufficient period of time, they retain the light energy and will remain visible (glow-in-the-dark) in complete darkness for up to 8 hours.

Maintenance (O&M Costs):

Signs must be tested periodically with a light meter for intensity, and replaced when necessary.

Other (Comments):

Current Status and Issues:

The shuttle elevators should be completed by opening day. The local cabs will be phased in later.

GBA COMMENT: Has been ordered.

WTC LIFE SAFETY ENHANCEMENTS
FACT SHEET

Back-up Emergency Generators on Flat Bed Truck

Purpose:

To provide emergency back-up power in the event that primary power and existing back-up generator power fails.

Location and Number of Units (Purchase & Installation Cost)

2-1000 Kilowatt generators will be placed on a flat bed truck which will be located on West Street between Tower 1 and the Vista Hotel. Purchase and installation of generators will cost approximately $500,000.

Operating Characteristics and Technical Description:

Generators will be connected to the primary lighting cables in both towers and OCC using a transfer switch. The switch will automatically route power from the flat bed generators in the event that the primary power and existing generators fail.

Maintenance (O&M Costs):

Generator motors and power distribution systems must be inspected daily. Estimated annual Operations & Maintenance cost id approximately $25,000.

Other (Comments):

Other permanent backup power sources are also being explored (eg. PATH/PSE&G connection).

Current Status and Issues:

Generators are currently on order and will be available for use the week of 3/15/93 (prior to the start of the re-occupancy of tower 2. Tie in connections to the electrical distribution system will be completed by 4/1/93.

GBA COMMENT: Work nearing completion.

EXISTING FIRE SAFETY SYSTEMS
FACT SHEET

Alarm Reporting System for Smoke Detectors, Sprinkler Alarms, and Tamper Alarms (American Multiplex System)

Description:

System includes all base building and tenant smoke and sprinkler systems. System does not include MER smoke and sprinkler systems.

Current Status and Issues:

System is fully restored in Towers 1 & 2 except 1 WTC floors 53-55.
System is out of service in 4 & 5 WTC and the Sub-grade blast area.
All smoke detectors in towers 1 & 2 have been cleaned.

Public Address System

Description:

System provides warble tone fire signal to all areas of WTC and voice announcements to the core areas and some tenant areas.

Current Status and Issues:

System is fully restored except in the Sub-Grade blast area.

GBA COMMENT: In working order.

EXISTING FIRE SAFETY SYSTEMS
FACT SHEET

Fire Alarm Call Box System

Description:

One pull box on each floor allows floor occupants to report a fire or smoke condition to the NYFD and the OCC. The system also provides 2-way voice communication between the OCC and the floor warden.

Current Status and Issues:

System is fully restored except in the Sub-Grade blast area.

Fire Standpipe Phone System

Description:

A hard wired telephone system which provides voice communication between stations in the stairwells and the OCC and fire-pump rooms.

Current Status and Issues:

System is fully restored.

GBA COMMENT: Work in process.

EXISTING FIRE SAFETY SYSTEMS
FACT SHEET

Emergency Power System

Description:

In the event of a loss of normal power, this system provides emergency power to all life and fire safety systems including: all emergency communications systems; fire-pumps; egress lighting; elevators.

Current Status and Issues:

System is restored except for emergency power to 4 & 5 WTC.

Sprinkler System

Description:

The system provides automatic suppression of a local fire condition.

Current Status and Issues:

System is fully restored except in the Sub-Grade blast area. The concourse and the balance of the Sub-Grade is operational.

GBA COMMENT: Work in process.

EXISTING FIRE SAFETY SYSTEMS
FACT SHEET

Fire Standpipe System

Description:

The system provides firefighters with a valved water supply to extinguish fires.

Current Status and Issues:

System is fully restored except in the Sub-Grade blast area.

Elevator Communications System (Stentafone)

Description:

The system provides voice communication between elevator occupants and the OCC.

Current Status and Issues:

System is fully restored.

GBA COMMENT: Work in process.

EXISTING FIRE SAFETY SYSTEMS
FACT SHEET

Elevator Transport System

Description:

The system provides vertical transportation for building occupants under normal conditions and for firefighters in emergencies. It also may be used to facilitate building evacuation under fire department supervision.

Current Status and Issues:

Fire department response elevators have been returned to service.
All breached elevator shafts are now under repair.
The following cars are expected to be out of service on 3/19/93:
Tower A - Cars 1,2,3,4,6,7,8,9,12,13,24,25,26,58,J1
Tower B - Cars 8,9,10,11,51,52,53,K's

Structural Stabilization

Description:

Ensure that all structural steel is not in danger of failing.

Current Status and Issues:

The stability of the towers was never in question.
The columns supporting the Vista Hotel lost lateral bracing as a result of the blast.
Temporary bracing was restored as of 3/5/93.
Additional bracing of the columns is on-going to permit removal of debris and seriously damaged concrete slab.
Overall estimated quantity of debris is approximately 2,500 tons, of which approximately 1,250 has already been removed.
It is estimated that an additional 2 to 3 weeks will be required to complete the removal of debris, the placement of additional bracing, and the removal of seriously damaged slabs.
Reconstruction of the slab will be a normal construction project.

GBA COMMENT: 80% on line.

EXISTING FIRE SAFETY SYSTEMS
FACT SHEET

Firestairs

Description:

3 independent stairwells, with 2 hour fire rated walls, allow safe egress for evacuees in the core of each tower.

Current Status and Issues:

Doors and frames damaged in the emergency have been repaired. Cosmetic work is still in progress. All stairwells have been equipped with battery packs for stairwell emergency lights. (See separate "Battery Packs for Stairwell Lights" fact sheet for description.)

GBA COMMENT: Presently in good working order.

Satellite Communications Desk Fire Wardens
List Of Responsibilities

Duties include:

1) Monitors vertical stair/corridor patrols in zones.
2) Tests supplemental communications system (initially - cellular phones / long term - FM wireless system).
3) Collects floor warden attendance information from tenants daily.
4) Monitors CCTV in stairs and freight elevator lobbies.
5) Supplies fire safety plan, floor layout and mobility restriction listing to responding emergency personnel.
6) Tests fireman's recall of elevators (in conjunction with others).
7) Monitors elevator console when starter is absent/involved in other duties.
8) Releases door locks at request of OCC during fire emergency.
9) Coordinates with tests of fire safety equipment
10) Maintains local emergency kit (see separate fact sheet).
11) Responds to tenant questions regarding fire safety.

GBA COMMENT: In process.

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PORT AUTHORITY of NEW YORK and NEW JERSEY

World Trade Center
Vessey, Liberty, Church and West Streets
New York, New York 10047 and 10048

Visited: April 20, 21, 1993 File No. 93160-01
Engineer: Vincent E. Sbarra, P.E.

SUMMARY

Owner: Port Authority of New York and New Jersey

General Structural Data: Complex consists of a group of six fire resistive buildings, two of which are 110 stories in height. There are seven subgrade levels, each having a floor area of about 13 acres. The subgrade levels include the areas under the buildings.

Sprinkler Protection: Automatic sprinkler protection is provided on the subgrade levels. The concourse is unsprinklered except that the Mercantile areas and Shops are sprinklered. The Plaza Buildings are sprinklered and the two towers are 75% and 85% sprinklered.

Watch and Alarm Service: The Port Authority Police Department maintains a 24 hour staff within the complex. Manual fire alarms on each floor go to the Fire Department, other alarms including smoke detectors, waterflow alarms, etc. go into the multiplex alarm system. The Multiplex alarm system rings at a 24 hour occupied desk.

Fire Department: The paid New York City Fire Department is located across the street.

Protection grading: New York City provides a superior degree of public protection.

Management Interest: Is good at this location.

The Port Authority Risk Management Department provides excellent staff back-up for local line management.

LOSS ESTIMATES

MFL (Maximum Foreseeable Loss - Assumes no automatic sprinkler protection in service):

10% based on a fire in the subgrade spreading into one of the buildings and smoke entering all buildings.

PML (Probable Maximum Loss - Assumes protection features in service with the exception of one water supply):

3% based on the loss of three unsprinklered floors plus smoke and water damage on several adjacent floors.

NLE (Normal Loss Expectancy - Assumes all protection features in service):

2% based on the loss of two adjacent floors plus some smoke and water damage. NOTE: Existing plans are to install additional sprinkler systems so that there will no longer be any adjacent unsprinklered floors by November, 1993. This would reduce the N.L.E. to 1%.

Risk Grades: Good in class as a high rise office building complex.

Fire Areas: Risk is all one fire area and total values are subject to one fire.

PUBLIC PROTECTION

Protection Grading: Is superior from New York City.

Fire Department: Paid company, located across the street. Fire alarm by public alarm box located within the building.

Public Water Supply: The gridded New York City downtown distribution system supplies the area. Static pressure at the site is about 60 psi. The public water supply is reliable. No deficiencies noted.

Private Water System:

Standpipe Water Supplies: Consist of a connection to the 12 inch grid of the City of New York. 750 gpm adjustable standpipe pumps are located on the B1, 7th, 41st and 75th floors of both towers. Five thousand gallon reserve tanks are located on the 20th, 41st, 75th and 110th floors of Tower A and 41st, 75th and 110th floors of Tower B. The tanks are automatically filled from the domestic water system lines. On the 109th floor there is a cross-connection from the standpipe to the sprinkler system. Each stair (A, B and C) has a riser with a hose station on each floor.

Sprinkler System Water Supplies: There is a 10,000 gallon tank on the 110th floor. Floors 108, 109 and 110 are supplied from a 500 gpm at 60 psi pump on the 108th floor. Floors 107 down to 32 are supplied by gravity using PRV's where needed. The 41st floors' 5,000 gallon reserve tank serves both sprinklers and standpipe systems. The Concourse and subgrade levels are supplied from a 1,500 gpm at 90 psi booster pump. (Also see the Appendix for the latest pump test information).

Loss Prevention: Fire Brigade consisting of Port Authority Police is organized. Frequent training sessions are held. Loss prevention self-inspections are being made; inspections are being recorded as are Maintenance inspections.

Activity: The building is basically a seven day per week, 24-hour per day operation with the greatest activity during normal business hours.

EXPOSURES

Exposures are light. About 75 feet across the narrowest street surround the complex to exposing downtown buildings.

ALARM EQUIPMENT

Fire Alarm System: An automatic smoke detection system is provided with detectors in front of each of four to eight air intakes on each floor and in all elevator lobbies, with signals transmitted to the proprietary panel located at the Operations Control Center (OCC) which is manned 24-hours per day. One manual fire alarm box is located in the center core and is connected directly to the Fire Department. Waterflow alarms on sprinkler system supply pipe are connected to the 24-hour manned OCC. Supervisory alarm service is provided on valves. Signals are transmitted to proprietary panel located at the OCC (Operations Control Center).

TOWER A

CONSTRUCTION

Construction: Building was constructed in 1973 and is in good repair. Construction is 100% fire resistive.

Area: Each floor is 43,681 sq. ft. Total area: 4,804,910 sq. ft.

Height: 110 story and six basements. 1,350 ft. above grade.

Walls: Exterior walls consist of a series of steel I-beams with sprayed on fire protection and a stainless steel skin connected by glass panels.

Roof: Reinforced concrete.

Ceilings: Mostly noncombustible suspended tiles. Open ceilings are in some unoccupied areas, mechanical equipment rooms and service equipment rooms.

Floors: Reinforced concrete on metal pan on protected bar joist.

Vertical Openings: Three enclosed stairs and 99 enclosed elevators (only one goes the entire height of the building).

OCCUPANCY

This tower is used basically as an office building.

EXPOSURES

Exposures are moderate. The building lobby is not cut-off from the Concourse areas except by glass partitions.

COMMON HAZARDS

Smoking: "No Smoking" rule is enforced.

Trash: Trash and floor sweepings are properly disposed of.

Housekeeping: Housekeeping is good.

Electrical Systems: Power transformers are located in cut-off equipment rooms and vaults. Electrical wiring installed in conduit. Twenty ampere circuit breakers protect branch circuits. No overheating noted. The aluminum feeder cables use crimped mechanical connectors which are listed by Underwriters Laboratories and recommended by the aluminum industry for use in connections between aluminum and copper conductors.

Heating, Ventilation and Air Conditioning Systems: Heat is hot air and hot water supplied from heat exchangers connected to Public Utility steam supplies. Approved safety controls are provided. Air conditioning compressors are located in cut-off equipment room on the B5 level. Refrigerant is freon. Temporary chillers have been located outside the building complex at grade level.

SPECIAL HAZARDS

Windows on the World Restaurant: The hoods, ducts and all cooking surfaces are protected with Underwriters' Laboratory listed automatic dry chemical extinguishing systems serviced on a regular basis. The hoods have Underwriters' Laboratory listed grease extractor systems and are chemically cleaned on a regular basis.

AUTOMATIC SPRINKLER EQUIPMENT

The Tower is about 75% sprinkler protected; the exceptions being Mechanical Equipment Rooms and some tenant floors. Work to sprinkler the tenant floors is continuing.

Type of Systems: Wet pipe systems.

Valves: Inside O.S.&Y. control valves. Valves found supervised and/or locked open.

ALARM EQUIPMENT

Fire Alarm System: An automatic smoke detector system is provided with detectors in front of each of 4 to 8 air intakes on each floor and in all elevator lobbies, having signals transmitted to the proprietary panel located at the Operations Control Center (OCC) which is manned 24 hours per day and has the capacity of contacting the Fire Department directly. Manual fire alarm boxes are located in the center core areas and connected directly to the Fire Department. Waterflow alarms on sprinkler system supply pipes are connected to the 24-hour manned OCC. Supervisory alarm service is provided on sprinklers and valves. Signals are transmitted to proprietary panel located at the OCC.

TOWER B

CONSTRUCTION

Construction: Building was constructed in 1973 and is in good repair. Construction is 100% fire resistive.

Area: Each floor is 43,681 sq. ft. Total area: 4,804,910 sq. ft.

Height: 110 story and six basements. 1,350 ft. above grade.

Walls: Exterior walls consist of a series of steel I-beams with sprayed on fire protection and a stainless steel skin connected by glass panels.

Roof: Reinforced concrete.

Ceilings: Mostly noncombustible suspended tiles. Open ceilings are in some unoccupied areas, mechanical equipment rooms and service equipment rooms.

Floors: Reinforced concrete on metal pan on protected bar joist.

Vertical Openings: Three enclosed stairs and 99 enclosed elevators (only one goes the entire height of the building).

OCCUPANCY

This tower is used basically as an office building.

EXPOSURES

Exposures are moderate. The building lobby is not cut-off from the Concourse areas except by glass partitions.

COMMON HAZARDS

Smoking: "No Smoking" rule is enforced.

Trash: Trash and floor sweepings are properly disposed of.

Housekeeping: Housekeeping is good.

SOUTHEAST PLAZA - (4 World Trade Center)

CONSTRUCTION

Construction: Building was constructed in 1974 and is in good repair. Construction is 100% fire resistive.

Area: 616,984 sq. ft.

Height: 7 story and penthouse and basement.

Walls: Part decorative marble and part metal skin over steel with large glass areas.

Roof: Tar and gravel on concrete on metal deck on protected steel.

Ceilings: Are mostly noncombustible tiles or open as in mechanical equipment rooms.

Floors: Reinforced concrete on metal deck on protected steel.

Vertical Openings: Five enclosed passenger and 2 enclosed freight elevators, 6 enclosed stairs and one small glass enclosed mail chute.

OCCUPANCY

Office building with the Commodity Exchange located on the 8th floor.

EXPOSURES

Exposures are moderate.

COMMON HAZARDS

Smoking: "No Smoking" rule is enforced.

Trash: Trash and floor sweepings are properly disposed of.

Housekeeping: Housekeeping is good.

Electrical Systems: Power transformers are located in vaults and cut-off equipment areas. Electrical wiring installed in conduit. Fifteen and twenty ampere circuit breakers protect branch circuits. No overheating noted.

Heating, Ventilation and Air Conditioning Systems: Heat is hot air supplied from heat exchangers supplied with steam from the Public Utility. Approved safety controls are provided. Air conditioning compressors are located in cut-off equipment room in the subgrade. Refrigerant is freon.

AUTOMATIC SPRINKLER EQUIPMENT

Entire building is sprinklered.

Type of Systems: One 8" wet. No alarm valves.

Valves: Inside O.S.&Y. control valves. Valves found supervised open.

ALARM EQUIPMENT

Fire Alarm System: An automatic smoke detector system is provided with detectors in front of each return air intake and in elevator lobbies and is installed with signals transmitted to proprietary panel located at the O.C.C. which is manned 24 hours per day and has capacity of contacting the Fire Department directly. Manual fire alarm boxes are connected directly to the Fire Department.

NORTH EAST PLAZA - (5 World Trade Center)

CONSTRUCTION

Construction: Building was constructed in 1973 and is in good repair. Construction is 100% fire resistive.

Area: 774,984 sq. ft.

Height: 8 story and penthouse.

Walls: Part decorative marble and part metal skin over steel with large glass areas.

Roof: Tar and gravel on concrete on metal deck on protected steel.

Ceilings: Mostly noncombustible tiles, and partly open in mechanical equipment rooms and/or service areas.

Floors: Reinforced concrete on metal deck on protected steel.

OCCUPANCY

Office building.

EXPOSURES

Exposures are moderate.

COMMON HAZARDS

Smoking: "No Smoking" rule is enforced.

Trash: Trash and floor sweepings are properly disposed of.

Housekeeping: Housekeeping is good.

Electrical Systems: Power transformers are located in vaults and cut-off equipment rooms. Electrical wiring installed in conduit. Fifteen and twenty ampere circuit breakers protect branch circuits. No overheating noted.

Heating, Ventilation and Air Conditioning Systems: Heat is hot air supplied from public utility steam supplied heat exchangers. Approved safety controls are provided. Air conditioning compressors are located in cut-off equipment room in the subgrade. Refrigerant is freon.

AUTOMATIC SPRINKLER EQUIPMENT

Entire building is sprinkler protected.

ALARM EQUIPMENT

Fire Alarm System: An automatic smoke detector system is provided with detectors in front of each return air intake louvers and in elevator lobbies with signals transmitted to the proprietary panel located at the O.C.C. which is manned 24 hours per day. Manual fire alarms are connected directly to the Fire Department.

PUMP HOUSE

CONSTRUCTION

Construction: Building is in good repair. Construction is 100% fire resistive.

Height: A below grade pump house.

Walls: Reinforced concrete.

Roof: Reinforced concrete.

Ceilings: Open.

Floors: Reinforced concrete.

Vertical Openings: None.

OCCUPANCY

A pump house with filter screens for pumping river water to the World Trade Center complex for cooling purposes.

EXPOSURES

Exposures are light.

COMMON HAZARDS

Smoking: "No Smoking" rule is enforced.

Trash: Trash and floor sweepings are properly disposed of.

Housekeeping: Housekeeping is good.

Electrical Systems: Power transformers are located in an enclosed vault. Electrical wiring installed in conduit. Large ampere circuit breakers protect branch circuits. No overheating noted.

Heating, Ventilation and Air Conditioning Systems: Heat is hot air supplied from electric unit heaters. Approved safety controls are provided.

SPECIAL HAZARDS

The river water is treated with a liquid solution of Sodium Hypochloride which is properly handled and stored.

BELOW GRADE LEVELS (Also called sub-grade)

There are seven levels below the structures, each having a floor area of 13 acres. These levels are reinforced concrete and are used for Parking areas, Building Services, Service Offices and Shops, Tenant Services, Loading Docks and Storage Areas. (NOTE: At the present time parking has been discontinued.)

Comment: This complex has recently suffered a terrorist bombing of a very large magnitude. The bomb was in the subgrade and, although it caused considerable damage to flooring and building services, the important building support structure was only slightly damaged. Repair operations include several features which will provide for a much higher level of fire protection and security in the future. These repair operations are progressing at an accelerated pace and many are in effect already (See separate report.)

Electrical Systems: Power transformers are located in cut-off equipment rooms and vaults. Electrical wiring installed in conduit. Twenty ampere circuit breakers protect branch circuits. No overheating noted. The aluminum feeder cables use crimped mechanical connectors which are listed by Underwriters Laboratories and recommended by the aluminum industry for use in connections between aluminum and copper conductors.

Heating, Ventilation and Air Conditioning Systems: Heat is hot air and hot water supplied from heat exchangers connected to Public Utility steam supplies. Approved safety controls are provided. Air conditioning compressors are located in cut-off equipment room. Refrigerant is freon. Temporary chillers have been located outside.

SPECIAL HAZARDS

Observation Deck Snack Bar: The two hoods, ducts and all cooking surfaces are protected with Underwriters' Laboratory listed automatic dry chemical extinguishing systems with last service date of March, 1993. The hoods have Underwriters' Laboratory listed grease extractor systems. The date of last cleaning was December, 1992.

AUTOMATIC SPRINKLER EQUIPMENT

The Tower is about 85% sprinkler protected; the exceptions being Mechanical Equipment Rooms and some tenant floors.

Type of Systems: Wet pipe systems.

Valves: Inside O.S.&Y. control valves. Valves found supervised and/or locked open.

ALARM EQUIPMENT

Fire Alarm System: An automatic smoke detector system is provided with detectors in front of each of 4 to 8 air intakes on each floor and in all elevator lobbies, having signals transmitted to the proprietary panel located at the Operations Control Center (OCC) which is manned 24 hours per day and has the capacity of contacting the Fire Department directly. Manual fire alarm boxes are located in the center core areas and connected directly to the Fire Department. Waterflow alarms on sprinkler system supply pipes are connected to the 24-hour manned OCC. Supervisory alarm service is provided on sprinklers and valves. Signals are transmitted to proprietary panel located at the OCC.

APPENDIX A

Recent Standpipe and Sprinkler System Pump Test Results

THE PORT AUTHORITY OF NY&NJ MEMORANDUM

TO: August Preschle, Manager, World Trade Center
FROM: Russell E. Earle
DATE: January 6, 1992
SUBJECT: WTC 1991 STANDPIPE AND SPRINKLER FIRE PUMP CAPACITY TESTS

COPY TO: T. Cancelliere, N. Chanfrau, G. Cummiskey, M. deVries, R. Kudlacik

Risk Control Division (RCD) staff conducted annual capacity tests on the standpipe system fire pumps and the two 108th floor sprinkler system pumps on December 11 and 12, 1991. Test data sheets are attached.

Test results are satisfactory. RCD recommends relocation of the 3/4 inch circulating relief valve on 108 "B" sprinkler pump from the suction side to the discharge side. The 108 "A" pump has not been equipped with such a valve and RCD recommends that one be provided per NFPA20, 2-6.

We appreciate the cooperation of your staff during these tests. If you have any questions on this matter please call.

Russell E. Earle

Russell E. Earle
Supervisor
Fire Protection Engineering
Risk Control Division

et
Attachments

PUMP 750/1125 Gals. at 360/234 PSI Net Head
Centrifugal STUTE16X Stage 3
Make PEERLESS
Speed 1770 R.P.M. Impel. Diam. 16 11/16 Inches
Shop No. 80281-14

ELECTRIC MOTOR
Maker CONTINENTAL
Type or Form SN5855 D.C. Squirrel Cage Slip Ring
300 H.P. 3 Phase 60 Cycle
460 Volts 7 Speed 1755 R.P.M.
240 Amps. at full load
Shop No. F-83721

CONTROL PANEL
Maker LEXINGTON
Model No. or Type No. F-380-69X
Automatic and/or Manual MANUAL
Disc. Sw. YES Ammeter YES
Cir. Br. ITE-KFP-600 Voltmeter YES
Starter F-380-68 Pilot Light
Suct in Pressure NOT IN USE
Suct out Pressure NOT IN USE

GASOLINE ENGINE
Maker
No. Cylinders
Speed R.P.M.
No. Speed R.P.M.
Shop No.

REMARKS
ALL TESTS RUN ON 7TH SPEED.
DISCHARGE AND METERING DONE AT TANK ON 20TH FLOOR OF TOWER "A".
USED 111 BARTON METER MEASURING FLOW PRESSURE ACROSS ORIFICE.

Pump No. 360079 Used For STANDPIPE
Located at 294 LEVEL OF TOWER "A" IN MER
Tested by M. deVRIES, T. HUMPHREY WTC STAFF Date 12/11/91

Speed R.P.M.	Disch. Press lb. sq. in.	Suct. * Lift Head	Net Head lb. sq. in.	Streams No.	Streams Size	Pitot Press	Gals. Per Minute	Volts	Amps.	Ft. of Hose each stream
			CHURN							
1782	430	52	378	—	—	—	—	460	160	—
100% RATED CAPACITY @ RATED HEAD 360 PSI										
1767	400	46	354	—	—	—	750	460	290	—
150% RATED CAPACITY @ NOT LESS THAN 65% RH 234 PSI										
1767	360	34	326	—	—	—	1125	460	330	—

Kind and Size of Hose Used

* Readings marked + in suction column are heads above atmosphere, those marked − are lifts. Both refer to readings on suction gage and not to static head. They are given in lb. per sq. in.

PUMP 750/1125 Gals. at 360/234 PSI Net Head
Centrifugal STUTE/6X Stage 8
Make PEERLESS
Speed 1770 R.P.M. Impel. Diam. 16 11/16 Inches
Shop No. 80285-H

ELECTRIC MOTOR
Maker CONTINENTAL
Type or Form SNS855 D.C. Squirrel Cage Slip Ring
300 H.P. 3 Phase 60 Cycle
460 Volts 7 Speed 1755 R.P.M.
340 Amps. at full load
Shop No. FB3741

CONTROL PANEL
Maker LEXINGTON
Model No. or Type No. E-384-68
Automatic and/or Manual MANUAL
Disc. Sw. YES Ammeter YES
Pr. Br. ITE-KFP-600 Voltmeter YES
Starter E-384-68 Pilot Light
Suct in Pressure NA
Suct out Pressure NA

GASOLINE ENGINE
Maker
No. Cylinders
Speed R.P.M.
HP, Speed R.P.M.
Shop No.

REMARKS
SUCTION FROM CITY. TANK ON 20TH FLOOR USED FOR DISCHARGE AND METERING. RUN ON 7TH SPEED. ITT BARTON METER USED TO MEASURE FLOW PRESSURE ACROSS ORIFICE.

Pump No. 360083 Used For STANDPIPE
Located at 294 LEVEL TOWER "B" MER
Tested by M. deVRIES, J. HUMPHREY WTC STAFF Date 12/11/91

Speed R.P.M.	Disch. Press lb. sq. in.	Suct. * Lift Head	Net Head lb. sq. in.	Streams No.	Streams Size	Pitot Press	Gals. Per Minute	Volts	Amps.	Ft. of Hose each stream
			CHURN							
1780	425	53	372	-	—	—	—	480	155	—
100% CAPACITY @ RATED HEAD 360 PSI										
1763	400	46	354	-	—	—	750	480	290	—
150% CAPACITY @ NOT LESS THAN 65% TRH 234 PSI										
1761	260	44	316	-	—	—	1125	480	325	—

Kind and Size of Hose Used

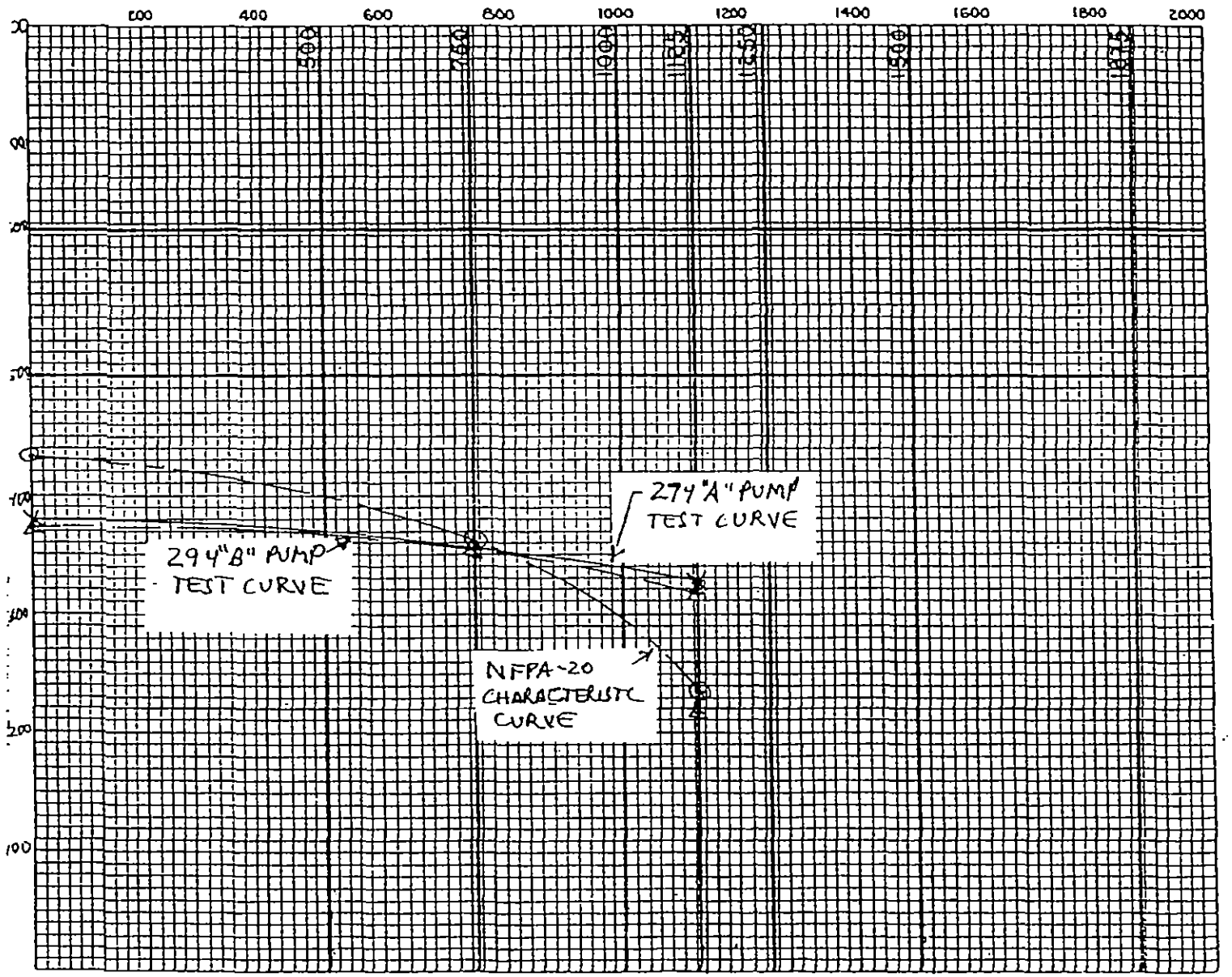
* Readings marked + in suction column are heads above atmosphere, those marked − are lifts. Both refer to readings on suction gage and not to static head. They are given in lb. per sq. in.

WORLD TRADE CENTER

294 LEVEL "A" AND "B"

FIRE STANDPIPE PUMPS

12/11/91



PUMP 750/1125 Gals. at 346/225PSI Net Head
Centrifugal 5 TVTF 16X Stage 3
Make PEERLESS
Speed 1170 R.P.M. Impel. Diam. 16 1/4 Inches
Shop No. 80282 H

ELECTRIC MOTOR
Maker CONTINENTAL
Type or Form _____ D.C. Squirrel Cage Slip Ring
250 H.P. 3 Phase 60 Cycle
460 Volts 7 Speed 1750 R.P.M.
285 Amps. at full load
Shop No. F83761

CONTROL PANEL
Maker LEXINGTON
Model No. or Type No. F-381-69X
Automatic and/or Manual MANUAL
Disc. Sw. YES Ammeter YES
Fr. Br. ITE-KFP-600 Voltmeter YES
Starter F-381-68 Pilot Light
Gage in Pressure NA
Gage out Pressure NA

GASOLINE ENGINE
Maker _____
No. Cylinders _____
Speed _____ R.P.M.
Gov., _____ Speed _____ R.P.M.
Shop No. _____

REMARKS
TO PERFORM 100% & 150% TESTS, RUN 294A PUMP ON 1ST STAGE. CHURN IS AT STAGE 6, 100% & 150% AT STAGE 7.
DISCHARGE METER ON 20TH FLOOR TANK. ITT BARTON METER USED TO MEASURE FLOW ACROSS ORIFICE.

Pump No. 360080 Used For STANDPIPE
Located at 7th FLOOR TOWER "A" IN MER
Tested by N. deVRIES, J HUMPHREY WTC STAFF Date 12/11/91

Speed R.P.M.	Disch. Press lb. sq. in.	Suct. * Lift Head	Net Head lb. sq. in.	Streams No.	Streams Size	Pitot Press	Gals. Per Minute	Volts	Amps.	Ft. of Hose each stream
			CHURN							
1763	415	67	348	-	-	—	—	460	140	—
	100% RATED CAPACITY @ RATED HEAD 346PSI									
1766	420	90	330	-	-	—	750	460	260	—
	150% RATED CAPACITY @ NOT LESS THAN 65% TRH 225PSI									
1761	330	28	302	-	-	—	1125	460	315	—

Kind and Size of Hose Used _____

* Readings marked + in suction column are heads above atmosphere, those marked - are lifts. Both refer to readings on suction gage and not to static head. They are given in lb. per sq. in.

PUMP 750/1125 Gals. at 346/225 PSI Net Head
Centrifugal 5 STG TF 16X Stage 3
Make PEERLESS
Speed 1770 R.P.M. Impel. Diam. 16 1/4 Inches
Shop No. 80286 H

ELECTRIC MOTOR
Maker CONTINENTAL
Type or Form SNSVSVS D.C. Squirrel Cage Slip Ring
250 H.P. 3 Phase 60 Cycle
460 Volts 7 Speed 1750 R.P.M.
285 Amps. at full load
Shop No. E8377

CONTROL PANEL
Maker LEXINGTON
Model No. or Type No. 501E38569
Automatic and/or Manual MANUAL
Disc. Sw. YES Ammeter YES
Pr. Br. ITE-KEP-600 Voltmeter YES
Starter E-385-68 Pilot Light
Suct in Pressure NA
Suct out Pressure NA

GASOLINE ENGINE
Maker
No. Cylinders
Speed R.P.M.
Type Speed R.P.M.
Shop No.

REMARKS
CHURN RUN ON 6TH STAGE
100 & 150% RUN ON 7TH STAGE
TO PERFORM TEST RUN
294 B PUMP ON 1ST STAGE
DISCHARGE AND METER
ON 4" B SUCTION FROM
TANK ON 20A. ITT
BARTON METER USED TO
MEASURE DIFF. FLOW
PRESSURE

Pump No. 360084 Used For STANDPIPE
Located at TOWER "B" 7TH FLOOR MEB
Tested by M. deVRIES, J. HUMPHREY WTC STAFF Date 12/11/91

Speed R.P.M.	Discharge Press lb. sq. in.	Suct. * Lift Head	Net Head lb. sq. in.	Streams No.	Streams Size	Pitot Press	Gals. Per Minute	Volts	Amps.	Ft. of Hose each stream
			CHURN							
1758	418	66	352	-	—	—	—	460	45	—
	100% CAPACITY @ RATED HEAD 346 PSI									
1726	425	98	327	-	—	—	750	460	260	—
	150% CAPACITY @ NOT LESS THAN 65% TRH 225 PSI									
1711	360	62	298	-	—	—	1125	460	300	—

Kind and Size of Hose Used

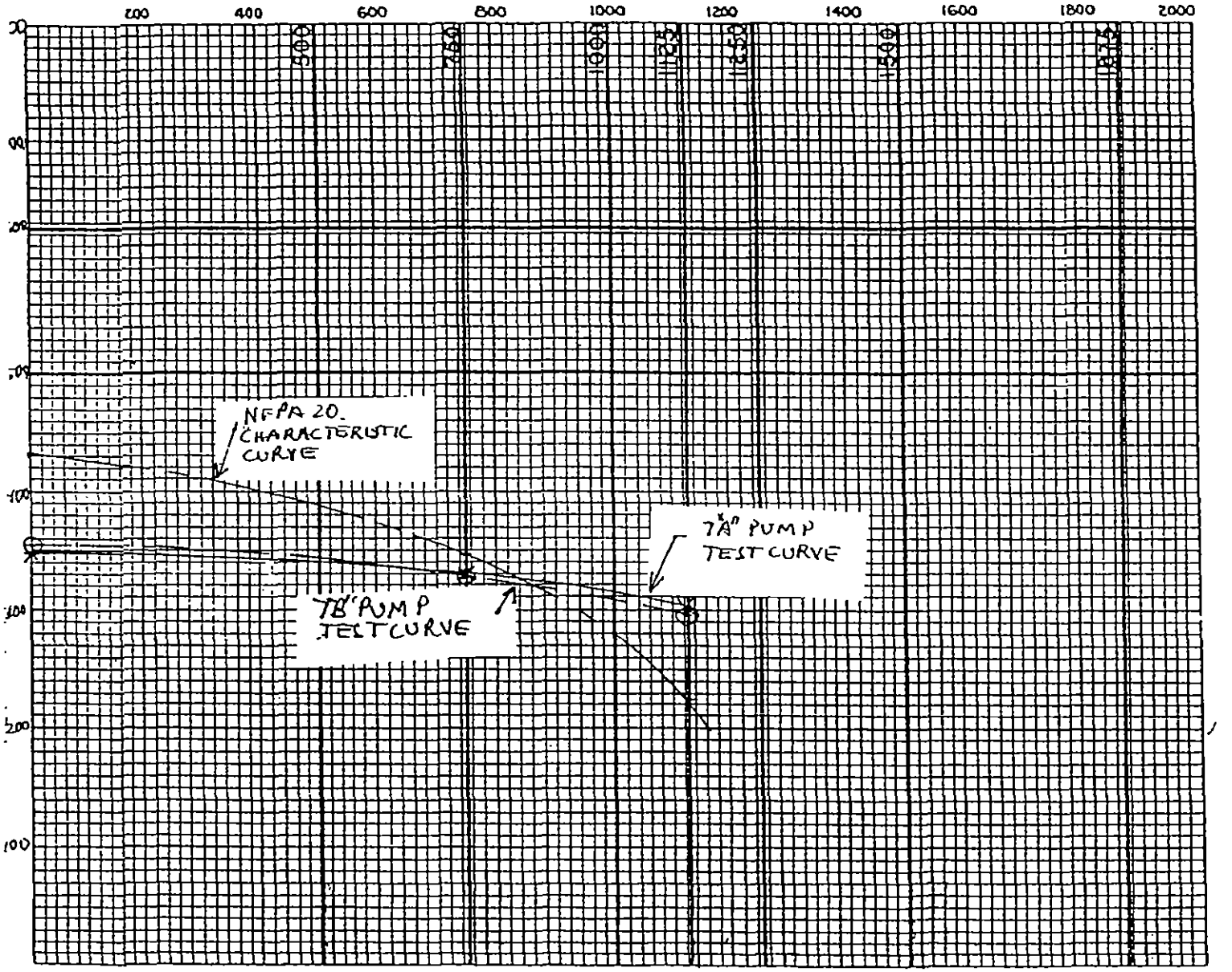
* Readings marked + in suction column are heads above atmosphere, those marked - are lifts. Both refer to readings on suction gage and not to static head. They are given in lb. per sq. in.

WORLD TRADE CENTER

7th FLOOR "A" AND "B" TOWER S.

FIRE STANDPIPE PUMPS.

12/11/91



FLOW IN GALLONS PER MINUTE

PUMP 750/1125 Gals. at 360/234 PSI Net Head
Centrifugal STUTE 16X Stage 3
Make PEERLESS
Speed 1770 R.P.M. Impel. Diam. 16 11/16 Inches
Shop No. 80283-H

ELECTRIC MOTOR
Maker CONTINENTAL
Type or Form SN585S D.C. Squirrel Cage Slip Ring
300 H.P. 3 Phase 60 Cycle
460 Volts 7 Speed 1750 R.P.M.
340 Amps. at full load
Shop No. F-83751

CONTROL PANEL
Maker LEXINGTON
Model No. or Type No. F-382-68X
Automatic and/or Manual MANUAL
Disc. Sw. YES Ammeter YES
Mfr. Br. ITE-KFP-600 Voltmeter YES
Starter F-382-68 Pilot Light
Suct in Pressure NA
Disch out Pressure NA

GASOLINE ENGINE
Maker
No. Cylinders
Speed R.P.M.
H.P. Speed R.P.M.
Shop No.

REMARKS
ALL TESTS RUN ON 7TH STAGE
USE 254A IMP ON 5TH STAGE FOR 100% & 6TH STAGE FOR 150% DISCHARGE TO TANK ONLY.
ITT BARTON METER USED TO MEASURE PRESSURE ACROSS ORIFICE TO DETERMINE FLOW.

Pump No. 360081 Used For STANDPIPE
Located at TOWER "A" - 41ST FLOOR MER.
Tested by R. deCURIES, J. HUMPHREY WTC STAFF Date 12/11/81

Speed R.P.M.	Disch. Press lb. sq. in.	Suct. * Lift Head	Net Head lb. sq. in.	Streams No.	Streams Size	Pitot Press	Gals. Per Minute	Volts	Amps.	Ft. of Hose each stream
		CHURN								
1779	460	78	382	-	-	—	—	460	160	—
100% CAPACITY TEST @ RATED HEAD 360 PSI										
1768	440	86	354	-	-	—	750	460	285	—
150% CAPACITY TEST @ NOT LESS THAN 65% RTH 234 PSI										
1767	360	63	297	-	—	—	1125	460	340	—

Kind and Size of Hose Used

* Readings marked + in suction column are heads above atmosphere, those marked - are lifts. Both refer to readings on suction gage and not to static head. They are given in lb. per sq. in.

PUMP 750/1125 Gals. at 360/234 PSI Net Head
Centrifugal STUTE 16X Stage 3
Make PEERLESS
Speed 1770 R.P.M. Impel. Diam. 16 11/16 Inches
Shop No. 80287-H

ELECTRIC MOTOR
Maker CONTINENTAL
Type or Form SN5855 D.C. Squirrel Cage Slip Ring
300 H.P. 3 Phase 60 Cycle
460 Volts 7 Speed 1750 R.P.M.
340 Amps. at full load
Shop No. E-83731

CONTROL PANEL
Maker LEXINGTON
Model No. or Type No. E-386-68
Automatic and/or Manual MANUAL
Disc. Sw. YES Ammeter YES
Pr. Br. ITE-KEP-600 Voltmeter YES
Starter E-386-68 Pilot Light
Suct in Pressure NA
Suct out Pressure NA

GASOLINE ENGINE
Maker
No. Cylinders
Speed R.P.M.
HP. Speed R.P.M.
Shop No.

REMARKS
ALL TEST RUN ON 7TH STAGE.
RUN 294B PUMP ON 4TH SPEED FOR 100% TEST & 150% TEST
ETT BARTON METER USED TO MEASURE PRESS ACROSS ORIFICE TO DETERMING FLOW.

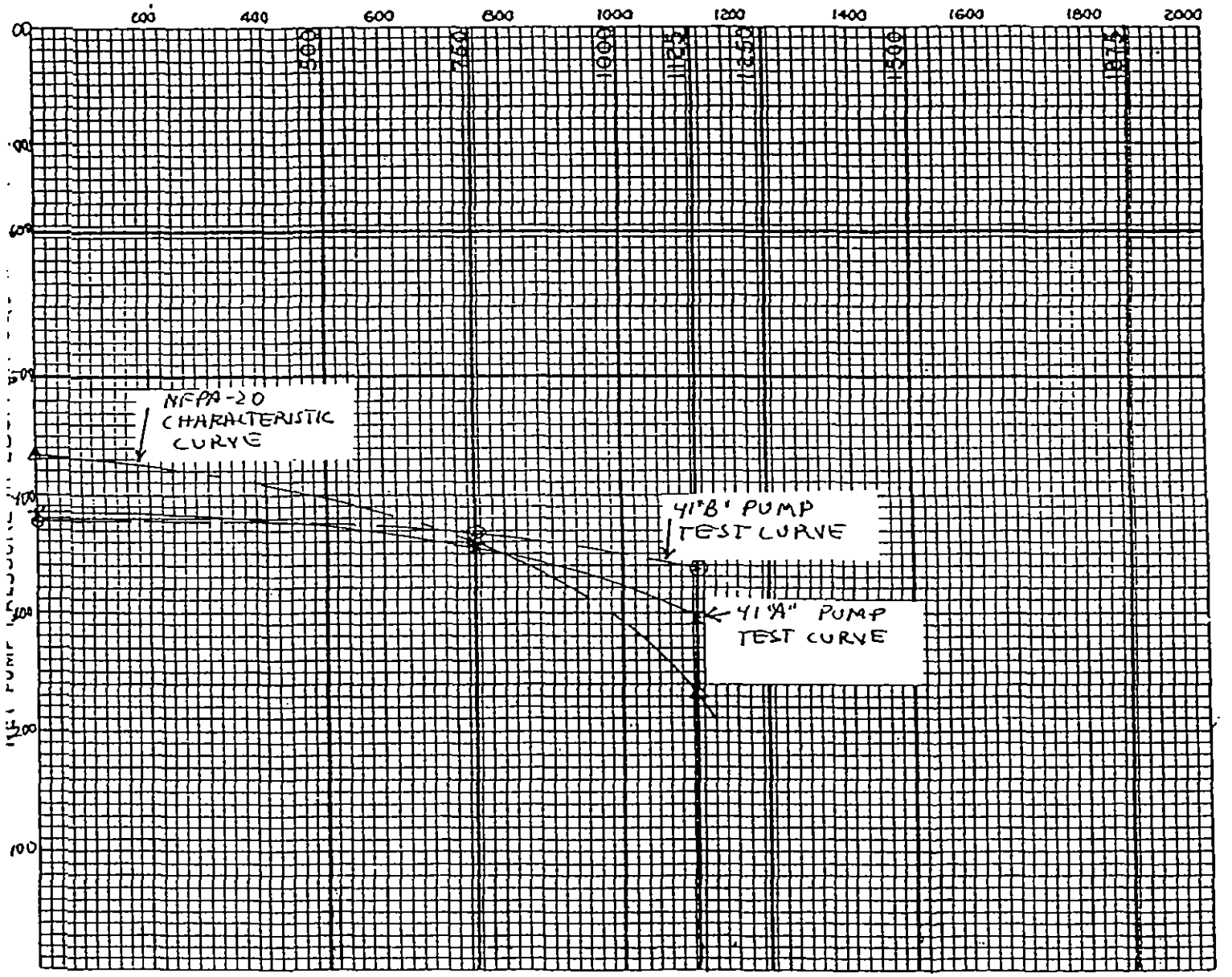
Pump No. 360085 Used For STANDPIPE
Located at TOWER "B" 41ST FLOOR MER
Tested by M. deVRIES, J. HUMPHREY WTC STAFF Date 12/11/91

Speed R.P.M.	Disch. Press lb. sq. in.	Suct. * Lift Head	Net Head lb. sq. in.	Streams No.	Streams Size	Pitot Press	Gals. Per Minute	Volts	Amps.	Ft. of Hose each stream
		CHURN								
1779	385	8	377	-	—	—	—	460	170	—
100% CAPACITY @ RATED HEAD 360 PSI										
1767	450	84	366	-	—	—	750	460	270	—
150% RATED CAP @ NOT LESS THAN 65% TRH 234 PSI										
1762	360	25	335	-	—	—	1125	460	315	—

Kind and Size of Hose Used

* Readings marked + in suction column are heads above atmosphere, those marked - are lifts. Both refer to readings on suction gage and not to static head. They are given in lb. per sq. in.

WORLD TRADE CENTER
41 ST FLOOR "A" AND "B" TOWERS
FIRE STANDPIPE PUMPS
12/11/92



PUMP 750/1125 Gals. at 228/148 PSI Net Head
Centrifugal 5 STUFF16X Stage 3
Make PEERLESS
Speed 1770 R.P.M. Impel. Diam. 16 11/16 Inches
Shop No. 8028 H

ELECTRIC MOTOR
Maker CONTINENTAL
Type or Form 5N445US D.C. Squirrel Cage Slip Ring
150 H.P. 3 Phase 60 Cycle
460 Volts -7 Speed 1750 R.P.M.
174 Amps. at full load
Shop No. E-83781

CONTROL PANEL
Maker LEXINGTON
Model No. or Type No. E-383-69X
Automatic and/or Manual MANUAL
Disc. Sw. YES Ammeter YES
Cir. Br. ITE-KEP-600 Voltmeter YES
Starter E-383-68 Pilot Light
Cut in Pressure N/A
Cut out Pressure N/A

GASOLINE ENGINE
Maker
No. Cylinders
Speed R.P.M.
H.P. Speed R.P.M.
Shop No.

REMARKS
CHURN TEST, 100% & 150% TESTS WERE RUN WITH 2ND A PUMP ON 7TH SPEED AND 4TH A PUMP ON 1ST SPEED. FOR HIGHER SUCTION PRESS AT 7SA, RUN 4TH A PUMP AT 2D SPEED. DISCHARGE IS TO 7SA TANK. ITT BARTON METER USED TO MEASURE PRESSURE ACROSS ORIFICE. 7SA PUMP RUN AT 5TH SPEED SETTING

Pump No. 360082 Used For STANDPIPE
Located at TOWER "A", 75TH FLOOR: MER
Tested by A. deVRIES, T. HUMPHREY (WTC STAFF) Date 12/11/91

Speed R.P.M.	Disch. Press lb. sq. in.	Suct. * Lift Head	Net Head lb. sq. in.	Streams No.	Streams Size	Pitot Press	Gals. Per Minute	Volts	Amps.	Ft. of Hose each stream
		CHURN								
1767	440	+93	247	—	—	—	—	460	105	—
100% CAPACITY @ RATED HEAD 228 PSI										
1752	300	70	230	—	—	—	750	460	170	—
150% CAPACITY @ NOT LESS THAN 65% TRH 148 PSI										
1742	200	1	199	—	—	—	1125	460	195	—

Kind and Size of Hose Used

* Readings marked + in suction column are heads above atmosphere, those marked − are lifts. Both refer to readings on suction gage and not to static head. They are given in lb. per sq. in.

PUMP 750/1125 Gals. at 228/148 Net Head
Centrifugal STUFF6X Stage 3
Make PEERLESS
Speed 1770 R.P.M. Impel. Diam. 13 9/16 Inches
Shop No. 80288H

ELECTRIC MOTOR
Maker CONTINENTAL
Type or Form SN445US D.C. Squirrel Cage Slip Ring
150 H.P. 3 Phase 60 Cycle
460 Volts 5 Speed 1750 R.P.M.
174 Amps. at full load
Shop No. F-83791

CONTROL PANEL
Maker LEXINGTON
Model No. or Type No. E-387-6
Automatic and/or Manual MANUAL
Disc. Sw. YES Ammeter YES
Cir. Br. ITE-KFP-600 Voltmeter YES
Starter E-387-68 Pilot Light
Cut in Pressure NA
Cut out Pressure NA

GASOLINE ENGINE
Maker
No. Cylinders
Speed R.P.M.
H.P. Speed R.P.M.
Shop No.

REMARKS
PUMP WAS ON SPEED 5 DURING ALL TESTS. 4IB PUMP ON 2:D STAGE FOR 100% TEST AND 3RD STAGE FOR 150% TEST. DISCHARGED TO 75A TANK. USED ITT BARTON METER TO MEASURE PRESSURE ACROSS ORIFICE

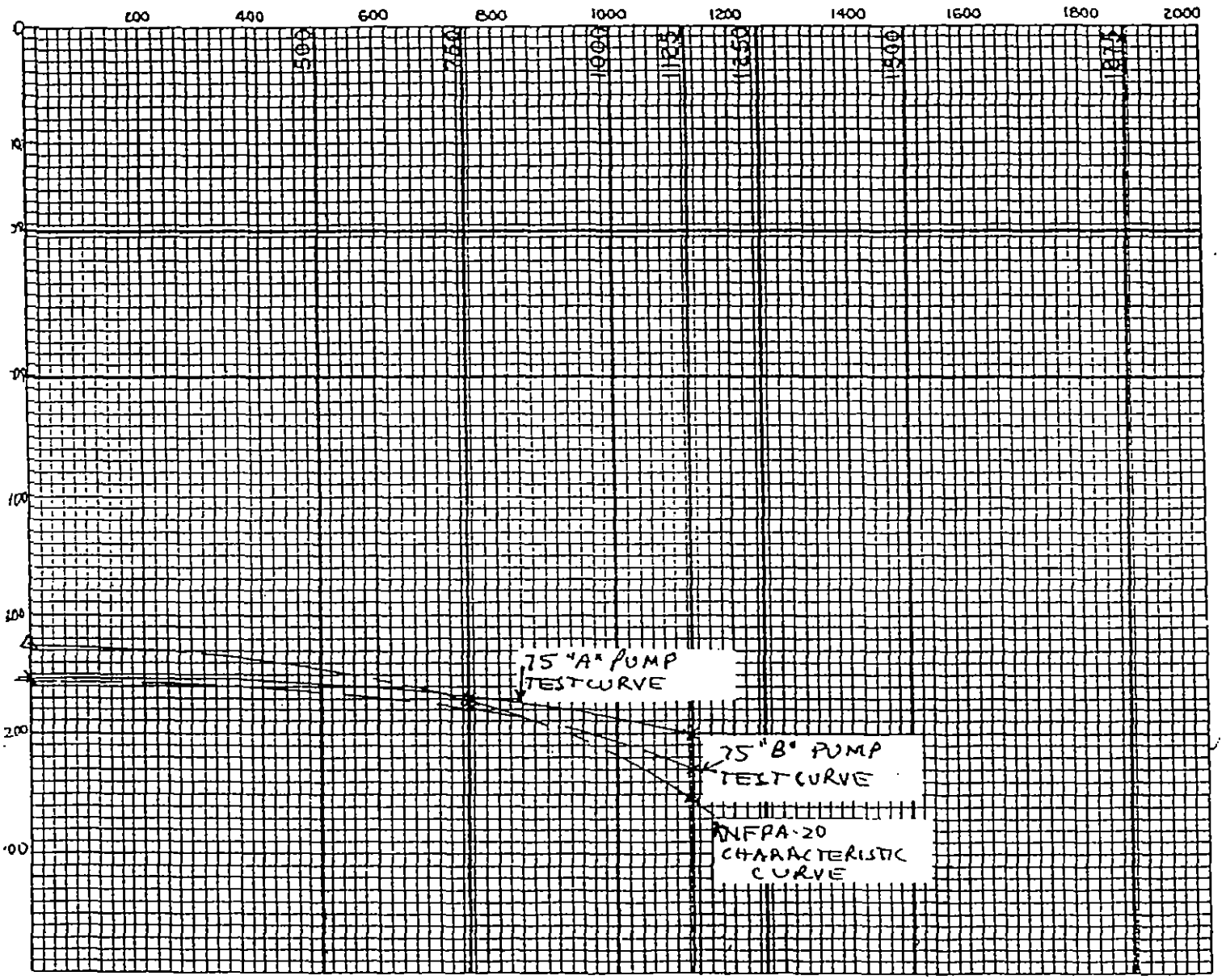
Pump No. 360086 Used For STANDPIPE
Located at TOWER "B" 75TH FLOOR MER
Tested by M deVRIES, J. HUMPHREY WTL STAFF Date 12/11/91

Speed R.P.M.	Disch. Press lb. sq. in.	Suct. * Lift Head	Net Head lb. sq. in.	Streams No.	Streams Size	Pitot Press	Gals. Per Minute	Volts	Amps.	Ft. of Hose each stream
		CHURN								
1772	305	62	243	—	—	—	—	460	85	—
	100% CAPACITY @ RATED HEAD 228 PSI									
1753	320	100	220	—	—	—	750	460	175	—
	150% CAPACITY @ NOT LESS THAN 65% TAH 148 PSI									
1745	195	25	170	—	—	—	1125	460	200	—

Kind and Size of Hose Used

* Readings marked + in suction column are heads above atmosphere, those marked − are lifts. Both refer to readings on suction gage and not to static head. They are given in lb. per sq. in.

WORLD TRADE CENTER
75TH FLOOR "A" AND "B" TOWERS
FIRE STANDPIPE PUMPS
12/11/92



PUMP 500/750 Gals. at 60/39 PSI Net Head
Centrifugal 4ABF13 Stage 1
Make PEERLESS
Speed 1760 R.P.M. Impel. Diam. 12.31 Inches
Shop No. _____

ELECTRIC MOTOR
Maker WESTINGHOUSE
Type or Form — D.C. Squirrel Cage Slip Ring
30 H.P. 3 Phase 60 Cycle
460 Volts 1 Speed 1765 R.P.M.
39.7 Amps. at full load
Shop No. 7501M

CONTROL PANEL
Maker LEXINGTON
Model No. or Type No. FD4207
Automatic and/or Manual AUTOMATIC
Disc. Sw. GETHED 13600 Ammeter NO
Cir. Br. GETHED 13600 Voltmeter NO
Starter GETHED 134100 Pilot Light YES
Cut in Pressure 50 PSIG
Cut out Pressure 75 PSIG

GASOLINE ENGINE
Maker _____
No. Cylinders _____
Speed _____ R.P.M.
H.P. _____ Speed _____ R.P.M.
Shop No. _____

REMARKS
A RECIRCULATING RELIEF VALVE IS ON WRONG SIDE (SUCTION) OF PUMP.

Pump No. 217018 Used For SPRINKLERS
Located at TOWER "B" 108TH FLOOR MER
Tested by M. deVRIES, T. HUMPHREY (WTC STAFF) Date 12/11/91

Speed R.P.M.	Disch. Press lb. sq. in.	Suct. * Lift Head	Net Head lb. sq. in.	Streams No.	Streams Size	Pitot Press	Gals. Per Minute	Volts	Amps.	Ft. of Hose each stream
		CHURN								
1792	135	70	65	—	—	—	—	480	22	—
100% CAPACITY TEST @ RATED HEAD									60 PSI	
1783	72	8	64	—	—	—	—	480	30	—
150% CAPACITY @ NOT LESS THAN 65% TRH 39 PSI										
*	60	2	58	—	—	—	—	480	35	—

Kind and Size of Hose Used _____

* Readings marked + in suction column are heads above atmosphere, those marked – are lifts. Both refer to readings on suction gage and not to static head. They are given in lb. per sq. in.

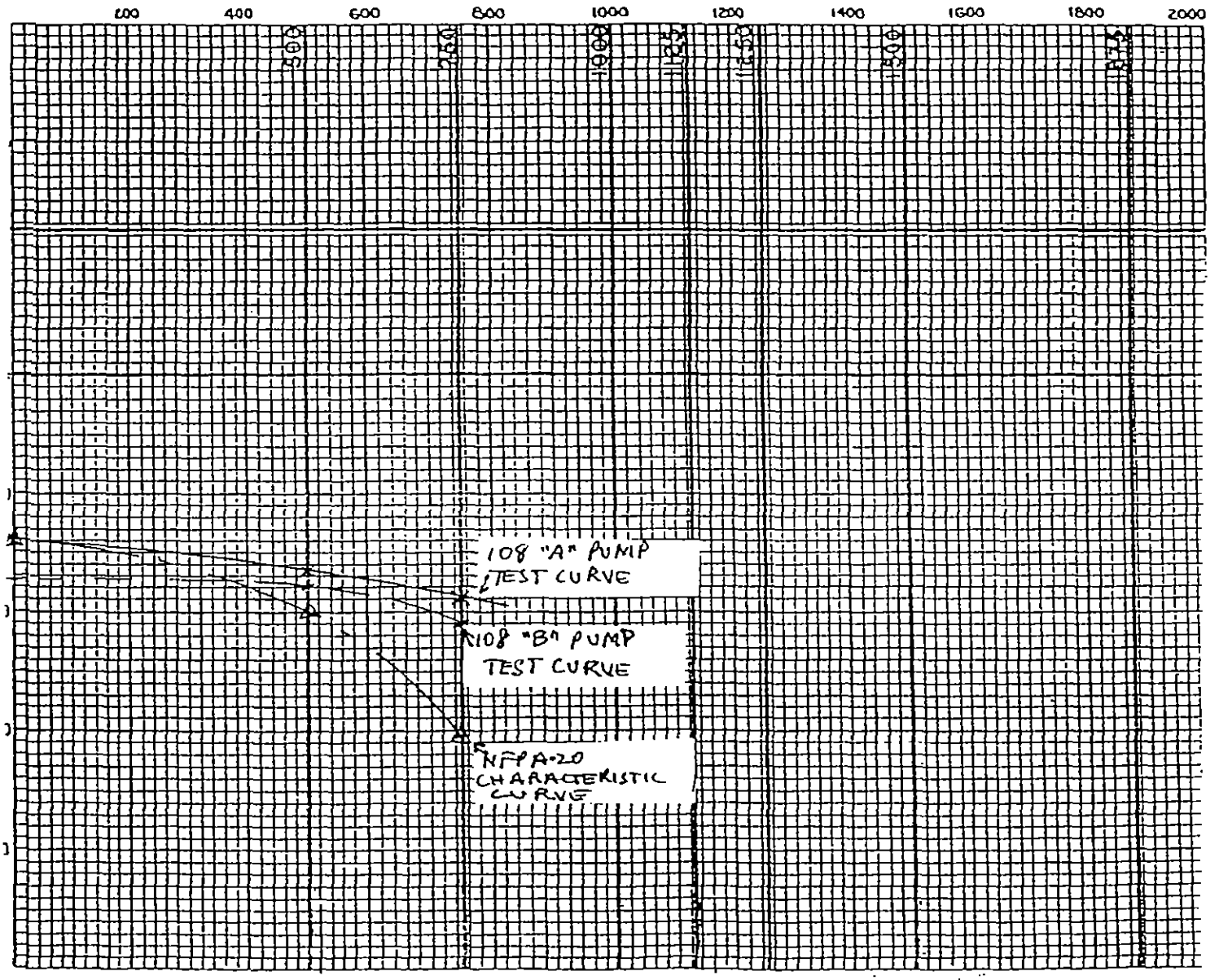
* TACHOMETER MALFUNCTION.

WORLD TRADE CENTER

108 TH FLOOR "A" AND "B" TOWERS

SPRINKLER PUMPS

12/11, 12/12/92



APPENDIX B

Recent Occupancy List

Towers A & B

WTC Tower A Occupancy

Run Time: 11:04 AM
Run Date: 4/8/93

No.	Tenant	Floor(s)	Date(s)	Business Resume Date
1	Cantor Fitzgerald	104–3247	27	
2	Brown & Wood	57-59	27	
3	Continental Fwdng.	2153	27	
4	Exec. Dir/PA	67	28	
5	Federal Home Loan	103	29-9	
6	Yasuda Bank	88	29-17	
7	Tokyo Securities	8969	29	
8	Bank of Kinki	8711	29	
9	Chugoku Bank	9007	29	
10	Int'l Office Center	7967	29	
11	Richard Kove Assoc.	8129	29	
12	Falcon Ital. Air Cargo	8345	29	
13	Municipal Asst. Corp.	8901	29	
14	Nishi-Nippon Bank	10227	29	
15	NY Metro. Trans Coun.	82	29	
16	Bank of Yokahama	8067	29	
17	Zim American Israeli	16	29	
18	San-In-Godo Bank	8403	29	
19	UKR-AMCO	7943	29	
20	Asiatic Corp. (USA)	8665	29	
21	Lehigh Court/Telarite	10425	29	
22	Sun Hung Kai	3915	29	
23	Banco Sud Americo	8947	29	
24	Vilas Fisher	2101	29	
25	J.F. Kilroy	1569	29	
26	CSCEC - US Inc.	2949	29	
27	Crowley American Trans.	2473	29	
28	Candia Shipping	1111	29	
29	Chang Hwa Bank	3211	29	
30	China Untied (CNCC)	3333	29	
31	Hanshin Securities	2149	29	
32	Loufbourrow Assoc.	2413	29	
33	Grigsby Branford Powell	1535	29	
34	American Sun Elec.	2967	29	
35	Ivory Coast Embasy.	2507	30–31	
36	CardCall Int'L	3269	30–31	
37	Cagney, Cole,	1543	30	
38	CEDEL	9051	30	
39	WTCA	7701, 3600	30	
40	Mutual Int'l Frwrdng.	2111	30	
41	Okasan Int'l Am.	8727	30	
42	Hachijuni	8697	30	
43	Federal Eastern Corp.	2447	30	

ME&A

No.	Tenant	Floor(s)	Date(s)	Business Resume Date
44	Norton Lilly	3047	30	
45	Sumitomo Marine&Fire	9035	30	
46	Shiga Bank	9165	30	
47	Ferromin Int'l Trade	1547	30	
48	Wako Securities	8369	30	
49	Kaiser Int'l Inc.	1583	30	
50	Daehan Invt' Trust	2547	30	
51	Porcella Vicini and Co.	2747	30	
52	Phillip Bros.	2855	30	
53	Marc Commodities	1541	30	
54	Mc Carter & English	1519	30-8	
55	Cosmopolitan Shpng.	1411	30	
56	Middle Market Group	1571	30	
57	Lucky Insurance	7705	30	
58	Employees Manpower	4587	30	
59	Dyson Shipping	1907	30	
60	Nicholas Spina	8929	30	
61	Ashikaga Bank	8151	30	
62	Tokyo Metro. Gov't.	7929	30	
63	Dr. T. Tokomano	2151	30	
64	Multinational Comp.	2135	30	
65	AIG Aviation	6353	30	
66	F.J. Wilkes & Co	2271	30	
67	PTP Commodities	1945	30	
68	Toho Bank	8353	30	
69	Chung Kwo Insurance	7941	30	
70	Valles Steamship Co.	51	30	
71	China Inter Ocean	3345	30	
72	Pecusa Co.	2775	30	
73	Vitol Int'l.	1551	30	
74	Sassoons	2245	30 or 1	
75	Commerzbank Markts.	4047	31	
76	Lucky Securities	8407	31	
77	Comcast Corp	8955	31	
78	Transit Center	2573	31	
79	Serko & Simon	3371	31	
80	Manhattan Inst. of Mgt.	10267	31	
81	W.A. Phelps	2109	31	
82	Thai Farmers Bank	8373	31	
83	Bankok Metro. Bank	2741	31	
84	Dong Suh Securities	2049	31	
85	Zenshinren Bank	8023	31	
86	Shanley & Fisher	8961	31	

WTC Tower A Occupancy

No.	Tenant	Floor(s)	Date(s)	Business Resume Date
87	Excel Shipping	1913	31	
88	Pacheco & Lugo	2961	31	
89	Harper Robinson & Co.	3973	31	
90	Develop. Bank of Singapore	9067	1	
91	Cultural Institutions	3969	1	
92	Manufacturers/Chemical	4501	1	
93	Alro Forwarding	2851	1	
94	Tong Yang Securities	3853	1	
95	Okato Shogi Co.	7927	1	
96	John Hancock	3841	1	
97	S. Stern Brokers	1419	1	
98	Chilean Trading Corp.	5151	1	
99	Nippon Express USA	1769	1	
100	Schwaben Int'l Inc.	1145	1	
101	First International	2013	1	
102	Italian Wine & Food	2263	1	
103	AAA & Bros Int'l Trade	4531	1	
104	Windows/World	106-107	1	
105	Trade Special Mgt.	4535	1	
106	United Hercules	2113	1	
107	Asahi Bank	6011/17	2-9	
108	Lunhan & Reed	3327	2	
109	Kerr Steamship	2169	2	
110	Commodities Future Trdg.	3747	2	
111	Blue Star Pace	8101	2	
112	Republic of France	5305	2	
113	Kirchner Moore/G. Baum	4627	2	
114	Chilean Line	3147	2	
115	China Resources	4621	2	
116	Overseas Union Bank	3955	2	
117	Security Traders Assoc.	4511	2	
118	Bank of Taiwan	5323	2	
119	Hokuriku Bank	8463	2	
120	New Japan Securities	9133/51	2	
121	Securities Consulting	8143	2	
122	Council on Int'l Banking	1963	2	
123	Sumitomo Bank	85,95, 96	2-3	
124	The Johnson Group	4517	2	
125	Company Store	4523	2	
126	Daichi Kangyo	48,49,50/51/52	3-10	
127	PA Cafeteria	43,44	3-4	
128	Viking Sea Freight	2409	3	
129	G. Z. Stephans Inc.	1527	3	

ME&A

No.	Tenant	Floor(s)	Date(s)	Business Resume Date
130	Bank of Communications	2947	3	
131	National Custom Brkrs	1153	3	
132	Brauner Int'l Corp.	1109	3	
133	Northern Trust Int'l Bank	3941	3	
134	Ventura Ribeiro	2247	3	
135	Hills Betts & Nash	5215	3	
136	Nathaniels Ruvell	5205	3	
137	Score Risk Mgt.	5209	3	
138	Rohde & Liesenfeld	3271	3	
139	M. A. Katz	4515	4	
140	Irving R. Boody	5371	4	
141	Hyundai Securities	4525	4	
142	Teleport Comm. Group	5121	5	
143	Iyo Bank	7923	5	
144	PA Credit Union	1467	5	
145	Rolan Sabat/Auto Imp.	4685	5	
146	United Seamen's Service	2161	5	
147	Fukuoka City Bank	8419	5	
148	Shizuoka Bank	8025	5	
149	Grancolumbiana	2973	5	
150	Grant Int'l.	2565	5	
151	Sinochem Amer. Hld.	5301	5	
152	Hyakugo Bank	8501	5	
153	Inhilco Ballrooms	106	5	
154	Republic of China	7953	5	
155	Asbestos Control	2537	5	
156	Griggs & Santow	2509	5	
157	Gulfstream Commod.	2743	5	
158	Turner Construction	1969	5	
159	Sangyo Co. Limited	1147	5	
160	Valles Shipping	1151	5	
161	Organizacion Venimpex	2553	5	
162	Krikor Pepazian	7947	5	
163	Korea Associated Sec.	3311	5	
164	Bramax Mfg.	4537	5	
165	Council Gen. of Paraguay	1947	5	
166	BAO Hercules	4521	5	
167	Manhattan Cult. Council	1717	5	
168	PA Departments	Various	6-9	
169	Amroc Int'l Corp.	2269	6	
170	Mission of Chn. Govt.	2273	6	
171	China Patent&Trdmrk	2551	6	
172	Dynamic Harvester	2841	6	
173	Hirschbach & Smith	1407	6	

WTC Tower A Occupancy

No.	Tenant	Floor(s)	Date(s)	Business Resume Date
174	Peter the Great	1709	6	
175	Venture Mgt. Consulting	2141	6	
176	W&C Allen & Co.	1413	6	
177	Int'l Cobal Inc.	2145	6	
178	Tradeway Inc.	4653	6	
179	Chase Manhattan	78	67	
180	Tower Computer Services	2981	67	
181	Cooper Neff & Assoc.	2511	67	
182	INSCI	2241	67	
183	R.F. Carroll & Co. Inc	2143	67	
184	Software Research	4539	67	
185	ADS Associates	2751	7	
186	Showa Leasing	8909	7	
187	Daewoo	8949	7	
188	Fortis	5001	7	
189	Chase Manhattan	78	7	
190	Financial Tech Int'l L.P.	4609	8	
191	Olimp Int'l	8051	9	
192	Berol & Mullen	29	9	
193	Cordoba Trade Ctr.	1509	9	
194	Jacom	5347	10	
195	Natural Nydegger	53	12	
196	Cumulus I	4467	12	
197	Century 21	8735	14	
198	Noga Commodities	8041	15	
199	John McMullen Assoc.	3000	17	
200	Mancini Duffy	1745	17	

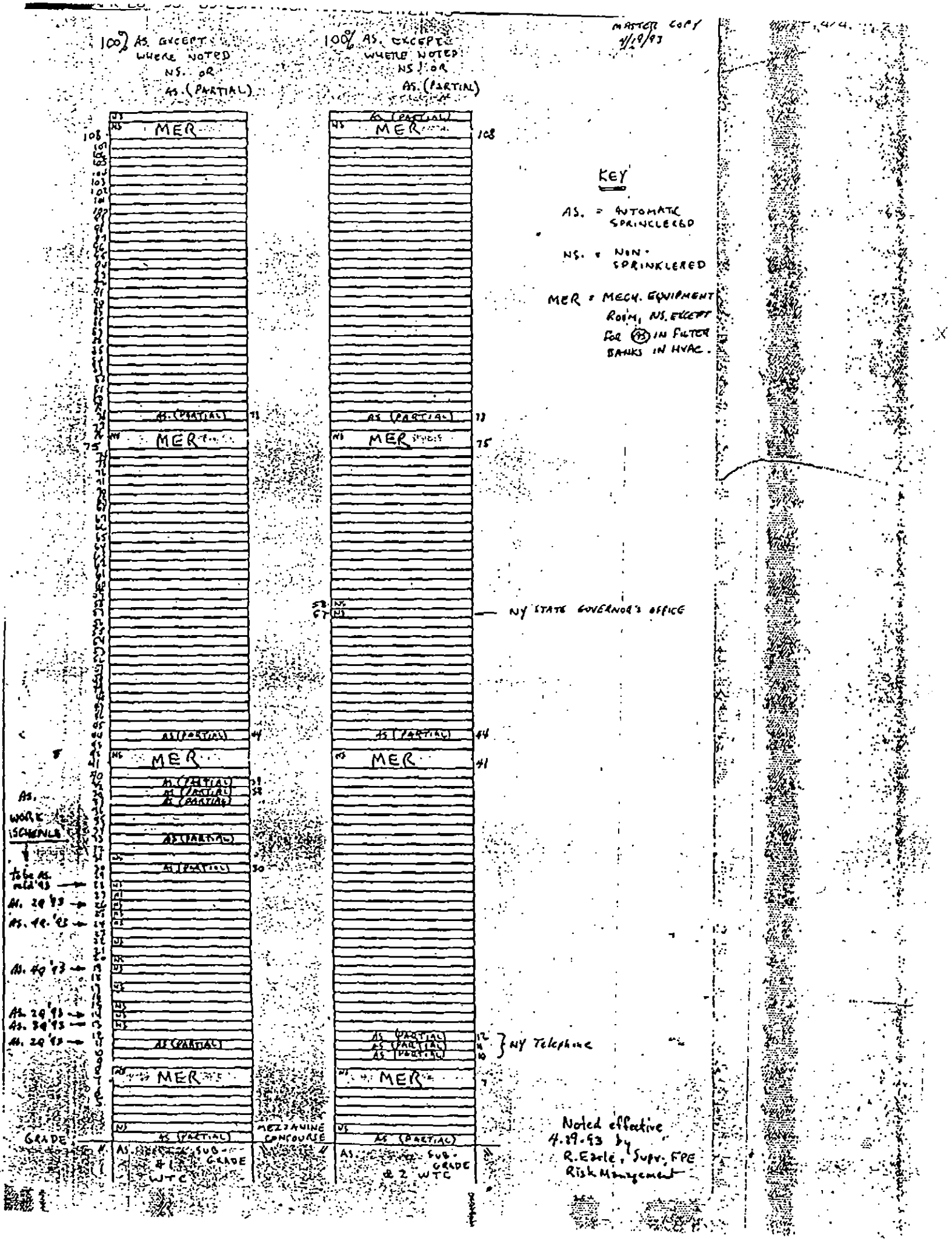
Approximate Floors Occupied (partial or full)
AS OF 4/9, 6 AM: 77

WTC Tower B Occupancy

Run Time: 10:23 AM
Run Date: 4/8/93

No.	Tenant	Floor(s)	Date(s)	Business Resume Date
1	NYS Governor	57	18	
2	Fiduciary Trust	94-97	18	
3	Harlow Mayer	55	19-21	
4	Dean Witter	17,22,43-46,56,69-74	19-26	
5	Fuji Bank	79-82	19-26	
6	Yamaichi	95,96,98	20	
7	Chuo Trust	8322	20	
8	Hokkaido	9928	21	
9	Ebasco	77-78,86-93	21-29	
10	Daiwa	25	21-24	
11	Farr Mann	3050	22-26	
12	Eurobrokers	84	22	
13	China Int'l Trust	2250	22	
14	Hua Nan Comm. Bank	2846	22	
15	Solar Int'l Shipping	2260	22	
16	First Comm. Bank	3328	22	
17	Tai Pei Bank	3328	22	
18	Mathews & Wright	2112	22	
19	World Teleport Assoc.	2150	22	
20	Keefe Bruyette	85	24	
21	Pagenet	1428	24	
22	Journal of Commerce	2750	24-26	
23	Fuyo/Fuji	81	25	
24	Kemper Insurance	3128	25-29	
25	C.P. USA	2158	25	
26	Marine Midland	23,24,25	26	
27	Thatcher Profit	39-40	26	
28	Oppenheimer Mgt.	3310, 34	26-28	
29	Brenner	3826	26-1	
30	H. Abbe Int'l	2844	26	
31	W.H. McGee	2910	26	
32	Shearson	100–102	26-3	

ME&A


100% AS. EXCEPT WHERE NOTED NS. OR AS. (PARTIAL)
100% AS. EXCEPT WHERE NOTED NS. OR AS. (PARTIAL)
MASTER COPY 4/19/93
KEY
AS. = AUTOMATIC SPRINKLERED
NS. = NON-SPRINKLERED
MER = MECH. EQUIPMENT ROOM, NS. EXCEPT FOR (AS) IN FILTER BANKS IN HVAC.
MER
NY STATE GOVERNOR'S OFFICE
NY Telephone
MEZZANINE CONCOURSE
SUB-GRADE #1 WTC
SUB-GRADE #2 WTC
GRADE
AS. WORK SCHEDULE
Noted effective 4.29.93 by R. Earle, Supv. FPE Risk Management